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Northeastern

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NORTHEASTERN FOREST EXPERIMENT STATION

Division of Watershed Management Research

Semi-annual Report

April 1962

GENERAL

Reading between the lines sent us by our watershed researchers, you will note that Ken Reinhart is somewhat harassed by our attempt to put the Fernow results in four periodicals and one Station paper plus a couple of other commitments we have made for him. Nevertheless, Ken is also digging deeper into the Fernow watershed records--research in depth, that is--driven as much by curiosity as a yen for basic research. Irv Reigner (our only watershed researcher solely responsible for 12 watersheds) continues to keep our cooperators happy while trying to meet yesterdays deadlines. Bob Pierce at Laconia spent much of the past 6 months on lab plans while George Hart toted textbooks at the University of Michigan; Ray Leonard kept the store. Art Eschner is also attending classes at Syracuse, sandwiching them in between snow surveys, and work-plan writing.

For a respite, we have scheduled a streamflow-data conference in June for all our watershed people, the Station statistical staff, Professors Sopper (Penn State) and Satterlund (Syracuse), and Coweeta's Ron Hibbert. Up for discussion will be our present and other means of compiling and analyzing streamflow records.

Elkins Research Center

With reduced staff (Art Eschner's replacement not due until April), we have been hard put to keep up with the routine load of record collection and compilation and an above-average publication commitment.

In addition, some analyses were accomplished in the period. One concerned an approach toward predicting the effect of heavy cutting on areas other than the experimental area. It dealt principally with the influence of amount and distribution of precipitation on the magnitude and timing of increase in discharge that might be expected to follow cutting. Another concerned the effect of the Fernow clear-cutting on surface runoff and storm flow. It showed that there was very little increase in surface runoff and the quantity of the increases in storm discharge ranged up to one-half area inch. With our logging method, most of the forest floor has remained essentially undisturbed; this probably explains why surface runoff and storm discharge were not greatly increased.

Another analysis showed that the commercial-clearcutting watershed 1 not only increased streamflow but it also reduced precipitation catch. The catch of one of the two precipitation gages (unshielded standard cans) over a 4-year period was reduced 3.2 percent (as estimated from a regression on the catch of a control gage outside the watershed), for the other gage, 2.7 percent. Before cutting the gages were in forest openings with a 45° opening. Clearcutting exposed the gages to unaccustomed drafts.

A conference was held with the USGS Groundwater Hydrologist at Morgantown in February; tentative plans were made for a limited investigation of groundwater conditions on the Fernow Experimental Forest.

We're looking forward to the arrival of James Hornbeck, who has just completed his work for Masters Degree at Penn State, about April 1st.

Ken Reinhart has been appointed to the Water Resources Committee of the Upper Monongahela Valley Association.

LACONIA RESEARCH CENTER

Windshields and Orifice Orientation for Rain Gages

A study of the value of windshields and tilting precipitation gages in a forest opening on one of the Hubbard Brook watersheds was concluded. Precipitation catch from standard gages equipped with Alter type windshields was compared with the catch from nonshielded gages. Some windshields were placed so the upper rim was horizontal, while others were tilted parallel to the slope. Likewise the orifice plane of the gage was placed either in a horizontal position or tilted parallel to the slope. Various combinations of the above were tried.

Our results were:

1. Alter type windshields increased the catch by about 5 percent during periods of snowfall, and 1 to 2 percent when rain fell.
2. Tilting the windshield parallel to the land slope had a negligible effect on the catch.
3. Tilting the gage parallel to the slope, when the gage was used in conjunction with the windshield, did not materially increase the catch.
4. A 2 percent increase was noted for a tilted gage as opposed to a nontilted gage when both were unshielded.

Results are being combined with Reinhart's Fernow comparison of rainfall catch in a forest opening and in a clearcut watershed for a Station Note.

Stilling Well Heater

A simple heater for eliminating ice development in gage house wells was designed and successfully used this past winter. The heater consists of a single gas pilot burner similar to those used as pilots for household gas cooking stoves. The burner is mounted on an empty one-gallon air-tight Prestone can which serves as a float. A piece of sheet zinc is fastened in a semi-circular fashion over the burner (Quonset-hut style) to the can so that heat is reflected downward. A short section of copper tubing is attached to the burner and is bent in an upside-down L so that the other end is 1 to 2 inches below the water line. Flexible plastic tubing is fastened to this end of the copper tubing and to the outlet of the tank of bottled gas propane). The below-water level junction of the copper and plastic tubing assures a cool connection eliminating excessive heat to the plastic. The floating heater imparts heat to the water surface by both reflection and conduction. Ice-free wells were achieved this winter with such heaters in spite of several prolonged periods of below zero weather. One twenty-pound capacity tank of gas will last for about two months.

Air and Snow Temperatures

An analysis of George Hart's air and snow temperatures from last winter's measurements gave some indication of the effect of snow depth on soil freezing. Air-temperatures regressed against temperatures within the snow pack at 6, 12, and 18-inch depths gave a family of linear regressions with progressively decreasing slopes with increasing snow depth. At 18 inches the relationship was horizontal at $31\frac{1}{2}^{\circ}\text{F}$ for a range of air temperatures from $31 - 4^{\circ}\text{F}$.

NEW LISBON RESEARCH CENTER

Since the addition of Karl Nicholas as a full-time aid to the watershed management staff, the backlog of streamflow charts is rapidly becoming meaningful data. Streamflow computations for the three Newark watersheds are up to date and the Baltimore watershed records are now being processed.

Penn State Watersheds

Bill Sopper finally has the three new watersheds at Penn State in production. Now twice as many charts have to be compiled, and the records calculated. The holdup on the new watersheds was from our end. We had considerable trouble obtaining clock parts to put a group of surplus recorders (donated by Coweeta) in operation.

Bill Sopper and Howard Lull got 17 years of daily discharge punch-carded for 62 Northeastern watersheds and fed it to the Penn State computers for comparisons of annual and seasonal discharge, flow duration, and peak flow by physiographic regions. Now they're studying results.

Newark Watersheds

In cooperation with the Soil Conservation Service, a soil survey has been started on the 3 small experimental watersheds. Sylvester Fletcher, soil scientist, has been classifying the soil series and types, and together we are attempting to describe the soils with an emphasis on their hydrologic characteristics. The rough rocky terrain on the higher elevations indicated very shallow soils, but surprisingly, pits showed soils of moderate depths, overlain by cobbles and larger stones. One more day in the field in April will complete the field work for the survey.

The bentonite treatment to plug the leaks in the concrete weir boxes was only partly successful. Leaks were noticeable in two weirs, one on the smallest watershed and the other on the largest of the three. Since treatment, there is no noticeable leak in the larger of the two weirs but the heavy winter flows may be masking the leaks. The treatment was not at all successful in the small weir--the leaks have increased to the extent that no flow is going over the notch.

Vinyl plastic, which has been used to line weirs at Baltimore and Penn State, has been purchased to line the small weir. If leaks become evident in the other weirs, they will also be lined with black vinyl.

Watershed Calibration

Following the publication of the fourth Dilldown Report, which presented data for four years after the calibration period, Herb Storey suggested we apply the relationships developed during the calibration period to the more recent data.

The predictions of monthly runoff were fairly accurate considering the unusual events that occurred during the post-calibration period: a serious fire that burned over about one-third of the watershed followed by Hurricanes Connie and Diane.

Annual runoff predictions, while not deviating seriously from actual measurements, formed a peculiar pattern. The deviations were closely related to the temperature variable. Subsequent investigation showed that the temperature variable, which was related to potential evapotranspiration, could not be used in all years with a moisture deficit during the growing season. It so happened that the two years with a moisture deficit during the calibration were the years of low annual precipitation. Thus, the latter inadvertently accounted for the

moisture deficit. But the same conditions did not prevail during the post-calibration period. Two of three years had very large moisture deficits, but had high annual rainfall (rainfall was heavier than normal during the dormant season) and so the regression equations did not predict runoff accurately.

Estimated evapotranspiration calculated by Thornthwaite's methods takes moisture deficits into consideration. The substitution of these data as an independent variable instead of the temperature variable resulted in more satisfactory estimates.

SYRACUSE

With the preparation and review of a problem analysis, this project is officially underway. The review was a one-day session attended by Herb Storey, Hal Wilm, Howard Lull, Ken Reinhart, Bob Pierce, and Art Eschner (a likely group), and educators Dean Shirley, Gene Farnsworth, and Don Satterlund. The approved problem analysis will be published by Syracuse. Conditions have not been ideal for the one study in progress. We picked a winter of abnormally low snowfall to investigate patterns of snow deposition and melt under several different forest types in the Allegheny Plateau. This year's 70 inch snowfall in this area is about three feet less than normal.

Plans are being made for studying the effect of land-use practices in the Adirondacks on streamflow. A number of long term USGS records are available for the area. New York State owns large blocks of a number of watersheds and the policy of no forest cutting has brought about improved cover conditions on these areas over the past several decades. This is a unique opportunity for relating large scale vegetation changes over a long period of time to changes in streamflow.

Professor Satterlund and Art Eschner prepared a short discussion entitled A Re-evaluation of the Watershed on a Reservoir for presentation at the April annual meeting of AGU.

PUBLICATIONS

Interception of precipitation by northern hardwoods. Raymond E. Leonard. Northeast. Forest Expt. Sta. Paper 159, 16 pp., illus.

Manuscripts Submitted

Snow and frost in hardwood stands and pine plantations in New Hampshire. George Hart.

A vinyl-lined weir for small-watershed studies. Irvin C. Reigner.

Effect on water quality of four forest practices and implications in trout management. Arthur R. Eschner and Jack Larmoyeaux.

Suburban hydrology--the Wissahickon watershed. Paul M. Felton and Howard W. Lull.

More water from the forest. Kenneth G. Reinhart and Howard W. Lull.

Cutting the forest to increase water yield. George R. Trimble and Kenneth G. Reinhart.